

Not
Entered

14611/US Hz/hr

09/647910

Rec'd PCT/PTO 06 OCT 2000

CLAIMS 1, 10

1. A sample taking apparatus, arranged for receiving a plurality of samples from a support material (40), characterized in that a plurality of separation tools (10) for taking the samples from the support material (40) are provided, wherein the separation tools (10) are arranged on a holding device (20) and are provided with respective actuating means (30), by which the separation tools (10) can be separately controlled and actuated.

10. A method for taking samples, wherein samples are cut from a support material (40) and transferred onto a target substrate (50), characterized in that cutting of the samples is carried out successively in time while using a sample taking apparatus (100) having a plurality of separation tools (10) being separately controlled and actuated and in that that the transfer of the removed samples onto the target substrate (50) is carried out parallel in time.

generally referred to as bands. The bands are irregularly distributed in the two-dimensional gel depending on the substance properties. For further processing or analysis of the separated fragments, the bands in the past have been cut out manually or semi-automatically by means of a scalpel from the gel in order to then perform specific further examinations, for example, by mass spectrometry.

In the aforementioned applications in genome research but also, for example, in the modern combinatorial chemistry, there is an interest to separate in time periods as short as possible a number of substances as large as possible and to further process the separated fragments or samples. The separation technique as well as the further analytical examination of the samples nowadays provide for a high sample throughput. The transfer of separated fragments onto substrates, which represent the starting point for further processing, however, represents a bottleneck to this day.

US-A-5 587 062 discloses a device for taking samples from an electrophoretic separation gel. The device contains a separation tool which is movable over a support table with the separation gel and operable for taking the samples.

It is an object of the invention to provide an apparatus and a method for taking samples, which are improved so as to allow a greater number of samples being simultaneously processed. The invention is particularly directed to applications in the gel electrophoretic separation methods.

This object is solved by an apparatus and a method including the features according to claims 1 and 10, respectively. Preferred embodiments of the invention are apparent from the dependent claims.

Firstly, by means of the guide part 21 an axial movability of the separation tools from a basic position into a punching position is determined. Moreover, each guide part 21 contains a connecting opening 21a via which the respective separation tool can be loaded by pressure, or alternatively vacuum, by means of a pressure system (not represented). The vacuum serves to secure the punched-out sample in the separation tool. When it is desired to place the samples onto the target substrate, the vacuum is replaced with a slight overpressure (in any case, for example, approximately $1/2$ technical atmosphere i.e. $5 \cdot 10^{-6}$ Pa). The connecting opening 21a can moreover be used for supplying a rinsing liquid.

For preventing sample migration in the capillary, a retaining device can be provided inside thereof which separates a sample volume at the end of the capillary from the remainder of the capillary and which can be formed, for example, by a pin in the capillary.

The actuating means 30 comprise a group of pneumatic cylinders 31, 32, ..., 38 each associated to a respective separation tool. The pneumatic cylinders are operated by compressed air and include electrical switching valves, respectively. When a certain pneumatic cylinder is activated by actuation of the electrical switching valve, the corresponding separation tool is moved in the axial direction by an advancing stroke. After completion of the punching process, the separation tool is returned due to the action of an internal spring element or an external restoring spring or equally by pressure application. An important advantage of the invention is that the separation tools or punching tools can be individually controlled so that the sample taking can be adjusted to any type of sample format.